Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims:

1. (Currently Amended) A device, comprising:

a cloud condensation nuclei chamber having an input to receive an aerosol flow, a region of supersaturation to grow cloud condensation nuclei, and an output to export the aerosol flow**, said cloud condensation nuclei chamber being oriented vertically to receive the aerosol flow from said input at the top and export the aerosol flow from said output at the bottom to direct the aerosol flow in a downward direction along a direction of the gravity**; and

a thermal control engaged to said chamber to produce a monotonic thermal profile **and a monotonic temperature gradient** in a stream-wise direction of the aerosol flow from said input to said output in said chamber.

2. (Original) The device as in claim 1, wherein a temperature in said chamber monotonically increases along the aerosol flow.

3. (Original) The device as in claim 2, wherein the temperature of said chamber linearly increases along the aerosol flow.

4. (Orignal) The device as in claim 2, wherein the temperature of said chamber nonlinearly increases along the aerosol flow.

5. (Original) The device as in claim 1, further comprising a flow control mechanism to split an air sample flow into the aerosol flow and a sheath flow, wherein the sheath flow is directed to flow along inner surfaces of said chamber to keep the aerosol flow away from the inner surfaces.

6. (Original) The device as in claim 5, wherein the sheath flow has a sheath flow rate higher than a flow rate of the aerosol flow.

7. (Original) The device as in claim 1, wherein said chamber has a cylindrical shape to direct the aerosol flow along an axis of the cylinder.

8. Canceled.

9. (Currently Amended) A cloud condensation nuclei measuring apparatus, comprising:

a chamber to receive an air sample **from a selected sampling location** and to keep said air sample **to flow in a downward direction along a direction of the gravity** in a region of supersaturation within a specified range;

a heating system providing **[[**an**]]** **a linearly** increasing temperature gradient along the axis of said chamber in the direction of flow; and

a particle counter coupled to said chamber to measure particles in said air sample output by said chamber and to provide a count indicative of particles within a selected size range, and

wherein the heating system is structured and controlled to produce **<u>the linearly increasing temperature gradient along the axis of said chamber in the direction of flow and</u>** a monotonic thermal profile in a stream-wise direction of the flow and to effectuate a nearly constant supersaturation along **[[**the**]]** **<u>said</u>** chamber.

10. (Original) The apparatus as in claim 9, further comprising a flow control mechanism to provide a sheath flow around the air sample in said chamber and to keep the air sample away from side walls of said chamber.

11. (Previously Presented) The apparatus as in claim 10, wherein a ratio of a flow rate of the sheath flow over a flow rate of the air sample is controlled between 5 and 20.

12. (Original) The apparatus as in claim 10, further comprising a heating element to heat the sheath flow at a temperature above a temperature of an end of the said chamber that receives the air sample.

13. (Original) The apparatus as in claim 9, wherein said chamber has a wetted inner surface.

14. (Original) The apparatus as in claim 13, wherein said chamber has a layer of a filter paper on the wetted inner surface.

15. (Original) The apparatus as in claim 13, wherein said chamber has a layer of a porous ceramic material on the wetted inner surface.

16. (Original) The apparatus as in claim 9, wherein said particle counter includes an optical particle counter.

17. Canceled.

18. (Currently Amended) The apparatus as in claim 9, further comprising:

a second chamber to receive a second air sample **from the selected sampling location** and to keep said second air sample in a region of supersaturation within a specified range;

a second heating system providing **[[an]]** **a second** increasing temperature gradient along the axis of said second chamber in the direction of flow; and

a second particle counter to measure particles in said second air sample output from said second chamber and to provide a count indicative of particles within a **second** selected size range **so that said first chamber and said second chamber operate in parallel to obtain two different aerosol measurements at the selected sampling location**.

19. (Currently Amended) A thermal gradient diffusion chamber for inclusion in a cloud condensation nuclei measurement

apparatus comprising **a cloud condensation nuclei column that forms a hollow channel to direct a received aerosol flow; a flow control mechanism to split an air sample flow into the aerosol flow along a first path and a sheath flow along a second, different path and comprising a particle filter in the sheath flow to remove particles in the sheath flow, and a humidifier in the sheath flow to provide a controlled humidity in the sheath flow, the flow control mechanism coupled to the cloud condensation nuclei column to direct the sheath flow to flow along inner surfaces of the cloud condensation nuclei column to keep the aerosol flow away from the inner surfaces;** a heat source to create an increasing temperature gradient in the direction of flow of **the aerosol flow** ~~an air sample~~ in said chamber**; and a particle counter coupled to the cloud condensation nuclei column to measure particles in said air sample output by the cloud condensation nuclei column and to provide a count indicative of particles within a selected size range**.

20. (Original) The chamber in claim 19, wherein said chamber has a wetted inner surface.

21. (Currently Amended) The **chamber** ~~apparatus~~ as in claim 19, wherein **the increasing temperature gradient** ~~temperatures~~ along the axis of said chamber linearly **increases** ~~increase~~.

22. (Currently Amended) A method for conditioning a sample in a cloud condensation nuclei measurement apparatus, comprising:

subjecting a sample passing through a column; and

subjecting said sample to an increasing temperature gradient in the direction of sample flow and to have a monotonic thermal profile in a stream-wise direction of the sample flow **to produce a substantially constant supersaturation**.

23. (Original) The method as in claim 22, further comprising using a sheath flow around the sample flow to keep the sample flow away from inner surfaces of the column.

24. (Original) The method as in claim 22, further comprising maintaining inner surfaces of the column wet with water.

25. (Original) A method, comprising:

directing an aerosol flow through a cloud condensation nuclei chamber to grow particles due to condensation from supersatuation; and

controlling a temperature profile of the chamber along the aerosol flow to produce a nearly constant supersaturation along the chamber.

26. (Original) The method as in claim 25, further comprising providing a sheath flow around the aerosol flow to reduce particle loss caused by contact of particles in the aerosol flow and inner surfaces of the chamber.

27. (Original) The method as in claim 25, wherein a temperature of the chamber increases monotonically along the direction of the aerosol flow.

28. (New) The device as in claim 1, wherein the temperature gradient in said chamber monotonically decreases along the aerosol flow.

29. (New) The device as in claim 28, wherein the temperature gradient of said chamber linearly decreases along the aerosol flow.

30. (New) The device as in claim 28, wherein the temperature gradient of said chamber nonlinearly decreases along the aerosol flow.

31. (New) The device as in claim 1, wherein said chamber has a chamber wall with a selected chamber wall thickness sufficiently large to make heat transfer in the chamber wall along the stream-wise direction greater than heat losses to the aerosol flow and to surrounding of said chamber.

32. (New) The device as in claim 1, wherein said chamber comprises an additional cloud condensation nuclei chamber segment that connects to said chamber and has a thermal profile different from the monotonic thermal gradient profile of said chamber.

33. (New) The device as in claim 32, wherein the monotonic thermal gradient profile in said chamber has a linearly increasing thermal gradient and the thermal profile of said additional cloud condensation nuclei chamber segment has a linearly decreasing thermal gradient.

34. (New) The device as in claim 32, wherein the thermal profile of said additional cloud condensation nuclei chamber segment has a constant temperature with a zero thermal gradient.

35. (New) The device as in claim 1, wherein the aerosol flow includes a gas that is different from air.

36. (New) The device as in claim 1, comprising a mechanism to supply a liquid to wet an inner wall of said chamber.

37. (New) The device as in claim 36, wherein the liquid is different from water.

38. (New) The device as in claim 36, wherein the inner wall of said chamber, which is wetted by the liquid, is made from a porous ceramic material.

39. (New) The device as in claim 36, wherein the inner wall of said chamber, which is wetted by the liquid, is made from alumina bisque.

40. (New) The device as in claim 36, wherein the inner wall surface includes gun-barrel-type grooves to assist the wetting of the inner wall surface.

41. (New) The device as in claim 1, comprising a feedback control that controls at least one of (1) a temperature of said chamber and (2) the aerosol flow to maintain a fixed supersaturation in said chamber.

42. (New) The device as in claim 5, comprising:

a humidifier in a path of the sheath flow to provide a controlled humidity in the sheath flow; and

a mechanism to supply a liquid to wet an inner wall of said chamber.

43. (New) The device as in claim 1, comprising a mechanism that modifies (1)the monotonic thermal gradient profile in the stream-wise direction of the aerosol flow and (2) the aerosol flow to generate cloud condensation nuclei spectra from said chamber.

44. (New) The device as in claim 1, comprising a mechanism for controlling sizes of aerosol particles of the aerosol flow in said chamber to be counted to increase a size threshold for particle counting at a low supersaturation and to decrease the size threshold at a high supersaturation.

45. (New) The device as in claim 1, wherein the monotonic temperature gradient linearly increases in the stream-wise direction of the aerosol flow.

46. (New) The device as in claim 1, wherein the monotonic temperature gradient nonlinearly increases in the stream-wise direction of the aerosol flow.

47. (New) The apparatus as in claim 18, wherein said first chamber and said second chamber have different lengths.

48. (New) The apparatus as in claim 18, wherein said first chamber and said second chamber have different temperature gradients.

49. (New) The apparatus as in claim 18, wherein said first chamber and said second chamber have different flow rates.

50. (New) The apparatus as in claim 18, wherein said first chamber and said second chamber have different internal pressures.